

EFFECT OF ORGANIC MANURES AND INORGANIC FERTILIZERS ON PLANT GROWTH, YIELD, FRUIT QUALITY AND SHELF LIFE OF TOMATO (*SOLANUMLYCOPERSICON*L.) C.V. PKM-1

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ABSTRACT

The present investigation entitled “Effect of Organic manures and Inorganic fertilizers on plant growth, yield, fruit quality and shelf life of Tomato (*Solanumlycopersicon*L.) C.V. PKM-1”, was conducted in Department of Horticulture, SHIATS and Allahabad 2013-14. The experiment was laid out RBD design with 13 treatments replicated thrice. The treatments consisted of different combinations of organic manures i.e, FYM, Poultry manure and Vermicompost and inorganic fertilizers. Among thirteen treatments under study, treatment T₇ (50% RDF + 50% FYM) recorded maximum plant height (133.53 cm), minimum days to first flowering (29.47), maximum number of flower clusters per plant (8.67), maximum number of flowers per cluster (7.27), maximum number of fruits per cluster (5.67), maximum number of fruits per plant (36.72), maximum average fruit weight (41.67g), maximum fruit yield per plant (849 g), maximum fruit yield per plot (13.50 kg) and maximum fruit yield per ha (33.77 t) followed by the treatment T₈ (50% RDF + 50% Poultry manure). Among quality parameters TSS (5.0⁰B) was found maximum in T₇ (50% RDF + 50% FYM) followed by treatment T₉ (50% RDF + 50% Vermicompost) whereas juiciness (33.84%), titrable acidity (1.06%), Ascorbic acid content (26.54mg/100 g fruit juice) and shelf life (11.67 days at normal room temperature) was maximum in treatment T₉ (50% RDF + 50% Vermicompost) followed by T₇ (50% RDF + 50% FYM). Maximum gross returns (Rs.3, 37,700 ha⁻¹), net returns (Rs.2, 14,925 ha⁻¹) and B:C ratio (2.75:1) was found with T₇ (50% RDF + 50% FYM).

KEYWORDS: Tomato, PKM-1, FYM, Poultry Manure, Vermicompost, RDF

INTRODUCTION

Tomato (*Solanumlycopersicon*L.) is an important vegetable crop in India, occupies an area of 880 MT/ ha with an annual production of 18227 MT/ha and productivity of 20.7MT/ha (NHB-2013). It belongs to family Solanaceae having chromosome number (2n=24). It is a self-pollinated crop and Peru-Ecuador region is the centre of origin. It contains higher quantity of total sugar (2.5- 4.5%), starch (0.6-1.2 %) and minerals like potassium, calcium, sodium, magnesium, phosphorus, boron, manganese, zinc, copper, iron, etc. Apart from these, it also contains organic acids such as citric, malic and acetic acids which are known as health acids in fresh tomato fruit. The flavor of tomato fruits is controlled by various volatile compounds like ethanol and acetaldehyde. Tomato juice promotes gastric secretion, acts as a blood purifier and works as intestinal antiseptic. It has been observed that sole application of organic manures or inorganic fertilizers are not able to sustain the soil fertility and crop productivity. However their integration has proved superior than individual components with respect to yield, quality and nutrient uptake (Abusaleha and Shanmulagavelu, 1988). However, considering the recent concept of eco-friendly and increase in cost of organic and inorganic fertilizers, the use of cost effective, eco-friendly and with suitable integration of organic manures and inorganic fertilizers restores the soil health

while keeping the soil productive and sustainable. Keeping in view all the above factors an experiment has been conducted to access the effect of organic manures and inorganic fertilizers on plant growth, yield, fruit quality and shelf life of tomato along with the comparative economics of various treatment combinations.

MATERIALS AND METHODS

An experiment was carried out at Horticultural Experimental field, Department of Horticulture, SHIATS, Allahabad during Rabi season of 2013-14. The experiment was laid out in randomized block design with 13 treatments replicated thrice. The treatments involved were T₁- control, T₂-RDF(150:100:50 kg/ha NPK), T₃-100% organic manures (33% FYM + 33% PM + 33% VC), T₄-75% RDF + 25% FYM, T₅-75% RDF + 25% PM, T₆-75% RDF + 25% VC, T₇-50% RDF + 50% FYM, T₈- 50% RDF + 50% PM, T₉- 50% RDF + 50% VC, T₁₀-25% RDF + 75% FYM, T₁₁-25% RDF + 75% PM, T₁₂- 25% RDF + 75% VC, T₁₃-25% RDF + 25% FYM + 25% PM + 25% VC.

Where in RDF: Recommended Dose of fertilizers, FYM: Farm Yard Manure, PM: Poultry Manure, VC: Vermicompost. The plot size was 2.0 x 2.0 m and spacing followed was 60 x 45 cm. The land was brought to a fine tilth by thorough ploughing and tillage. Irrigation channels and bunds were maintained properly. Thirty days old healthy and uniform seedlings were transplanted on 07th Oct. 2013. Light irrigation was given after transplanting. The organic manures were applied one week before transplanting, for proper decomposition, full dose of phosphorus and potassium and half dose of nitrogen as per treatment were applied just before the transplanting. The remaining half dose of nitrogen was applied 30 days after transplanting. All cultural practices were followed regularly during crop growth and observations were recorded on growth characters i. e, plant height, flower parameters like days to first flowering after transplanting, number of flower clusters per plant, number of flowers per cluster, and yield parameters like number of fruits per cluster, total number of fruits per plant, average fruit weight, yield per plant, yield per plot and yield per hectare and quality parameters like juiciness, TSS, acidity, and ascorbic acid and shelf life were recorded from time to time.

RESULTS AND DISCUSSIONS

Growth Parameters

The data revealed that the combination of different organic manures and inorganic fertilizers affected growth parameter like plant height of Tomato as shown in (Table 1). Significant difference in the plant height was recorded due to application of different combinations of organic manures and inorganic fertilizers. The treatment T₇ recorded the maximum plant height (133.53 cm), followed by T₈ (129.13 cm) which differed significantly from each other as well from other treatments. The increase in plant height in the treatments T₇ and T₈ might be due to the organic manure applied in the form of FYM and Poultry manure in combination with 50% RDF as inorganic fertilizers might have improved the soil physical and chemical properties and leading to the adequate supply of nutrients to the plants which might have Promoted the maximum vegetative growth while the minimum plant growth was due to non-availability of nutrients. Similar findings were reported by Patil *et al.* (2004) in tomato and Sugeet *et al.* (2011) in brinjal.

Flowering Parameters

The data revealed that the combination of different organic manures and inorganic fertilizers affected various flowering parameters as shown in (Table 1.) The treatment T₇ (50% RDF + 50% FYM) showed minimum days to first flowering after transplanting (29.47), maximum number of flower clusters per plant (8.67) and maximum number of flowers per cluster (7.27). The earliness to flowering in treatment T₇ might be due to the better translocation of nutrients to

the aerial parts. Similar findings were reported by Naidu *et al.* (2002) in tomato and Prativa and Bhattarai (2011) in tomato.

Yield Parameters

The data revealed that the combination of different organic manures and inorganic fertilizers affected yield parameters of Tomato as shown in (Table 2). In the present study, among the various treatment combinations T₇ (50% RDF + 50% FYM) recorded maximum number of fruits per cluster (5.67), maximum number of fruits per plant (36.72), maximum average fruit weight (41.67g), maximum yield per plant (849g), maximum yield per plot (13.50 kg) and maximum yield per hectare (33.77 t/ha) followed by T₈ (50% RDF + 50% PM) and minimum were recorded in T₁-Control. Maximum photosynthetic activity and accumulation of number of fruits in case of T₇ might be due to increased no. of flowers which might have formed into fruits due to adequate availability of major and minor nutrients during its growth and development. The increase yield per plant, per plot and per hectare might be due to the increased growth and flower attributes which in turn lead to the increased photosynthesis and dry matter production. Minimum number of fruits and yield in T₁. Control might be due to non availability of nutrients during its development. Similar findings were reported by Naidu *et al.* (2002) in tomato, Rafi *et al.* (2002) in tomato, Poulet *et al.* (2004) in tomato, Rodge and Yadlod (2009) in tomato and Sugeet *et al.* (2011) in brinjal.

Quality Parameters

The data revealed that the combination of different organic manures and inorganic fertilizers affected quality parameters of Tomato as shown in (Table 2). In the present study, among the various treatment combinations T₇ (50% RDF + 50% FYM) showed maximum TSS (5.0⁰B) followed by T₉ (50% RDF + 50% VC) (4.8⁰B). The juiciness (33.84%), acidity (1.06%) and ascorbic acid (26.54 mg/100g fruit juice) was found to be maximum in T₉ followed by T₇. Increase in quality parameters might be due to increased availability of major as well as minor nutrients especially nitrogen and potassium, as they play vital role in enhancing the fruit quality and minimum might be due to lack of availability of sufficient nutrients. Similar findings were reported by Krishna and Krishnappa (2002) in tomato, Patilet *et al.* (2004) in tomato, Singh *et al.* (2010) in field grown tomatoes.

Table 1: Effect of Organic Manures and Inorganic Fertilizers on Plant Growth and Flowering Parameters of Tomato c.V. pkm-1

Treatments		Plant Height (cm)	Days to First Flowering after Transplanting	No. of Flower Clusters Per Plant	No. of Flowers Per Cluster
T ₁	Control	110.53	41.67	5.93	4.87
T ₂	RDF (150:100:50 kg/ha NPK)	120.20	35.40	7.27	6.07
T ₃	100% Organic manures(33% FYM+33% PM+33% VC	111.40	40.33	6.27	5.07
T ₄	75% RDF + 25% FYM	126.80	32.47	7.73	6.53
T ₅	75% RDF + 25% Poultry manure	123.73	33.53	7.67	6.40
T ₆	75% RDF + 25% Vermicompost	121.87	34.53	7.47	6.27
T ₇	50% RDF + 50% FYM	133.53	29.47	8.67	7.27
T ₈	50% RDF + 50% Poultry manure	131.73	30.53	8.27	7.07
T ₉	50% RDF + 50% Vermicompost	129.13	31.67	8.00	6.87
T ₁₀	25% RDF + 75% FYM	118.60	36.67	6.93	5.87
T ₁₁	25% RDF + 75% Poultry manure	117.13	37.53	6.80	5.60
T ₁₂	25% RDF + 75% Vermicompost	115.47	38.33	6.67	5.47
T ₁₃	25% RDF + 25% Fym+25% PM + 25% VC	113.33	39.47	6.47	5.13
S. Ed. (±)		0.69	0.15	1.22	2.05
C. D. at 5 %		1.42	0.31	2.52	4.24

Table 2: Effect of Organic Manures and Inorganic Fertilizers on Yield, Fruit Quality and Shelf Life of Tomato C.V. PKM-1

Treatments	No. of Fruits Per Cluster	Total No. of Fruits Per Plant	Average Fruit Weight (G)	Yield Per Plant (G)	Yield Per Plot (Kg)	Yield Per Hectare (T)	Juiciness (%)	TSS (°B)	Titration Acidity (%)	Ascorbic Acid (Mg/100g)	Shelf Life of Flowers (Days)
T ₁	3.07	23.45	25.07	500	7.86	19.60	18.88	3.40	0.98	23.18	5.67
T ₂	3.93	30.73	33.53	656	8.48	26.31	20.44	3.67	0.90	23.86	6.33
T ₃	3.20	23.89	26.30	505	8.15	20.27	21.34	3.73	0.91	23.82	6.67
T ₄	4.73	33.66	36.07	750	12.01	30.03	29.60	4.53	1.00	24.69	9.00
T ₅	4.53	32.54	35.53	700	11.21	28.07	27.52	4.27	0.97	25.30	8.33
T ₆	4.33	31.89	34.73	680	10.89	27.23	29.84	4.47	1.01	25.64	9.67
T ₇	5.67	36.72	41.67	849	13.50	33.77	32.26	5.00	1.05	25.96	11.00
T ₈	5.33	35.53	39.70	800	12.80	32.03	30.63	4.67	1.03	26.17	10.67
T ₉	5.07	34.34	37.40	780	12.60	31.60	33.84	4.80	1.06	26.54	11.67
T ₁₀	3.80	29.56	32.87	605	10.52	24.23	24.54	4.13	0.94	23.91	7.67
T ₁₁	3.73	27.87	31.00	591	9.68	23.67	23.09	3.87	0.92	24.51	7.33
T ₁₂	3.60	26.54	28.87	561	9.47	22.47	26.00	3.93	0.96	24.43	8.00
T ₁₃	3.47	25.65	27.17	520	9.07	21.17	22.72	3.87	0.92	24.00	7.00
S. Ed. (±)	0.08	0.26	0.18	0.47	0.03	0.09	0.35	0.08	0.01	0.20	0.51
C.D.at 5%	0.17	0.54	0.37	0.96	0.06	0.18	0.73	0.16	0.02	0.41	1.06

Shelf Life

The data revealed that the combination of different organic manures and inorganic fertilizers affected shelf life of Tomato stored at normal room temperature as shown in (Table 2). The maximum shelf life of fruits at normal room temperature was observed in case of T₉ (11.67 days) followed by T₇ (11.00 days). Application of 50% organic manures (VC) and 50% inorganic fertilizers (RDF) might have reduced the rate of respiration and transpiration resulting in reduced ethylene production during storage of tomato fruits, increasing the shelf-life. Similar findings were observed by Patil *et al.* (2004) in tomato and Ranjita *et al.* (2013) in tomato.

CONCLUSIONS

On the basis of present study, it is concluded that the application of 50% RDF (150:100:50 Kg/ha NPK) + 50% FYM resulted in maximum plant height, yield and TSS where as Juiciness, Acidity, Ascorbic acid content and Shelf-life was maximum by the application of 50% RDF + 50% VC.

REFERENCES

1. Abusaleha and Shanmugavelu, K.G. (1988). Studies on the effect of Organic Vs Inorganic Source of Nitrogen on Growth, Yield and Quality of Okra (*Abelmoschus esculentus*), *Indian J. of Hort*, **45**(3 and 4):312-318. Anonymous 2011, National Horticulture Board.
2. Krishna, H.C. and Krishnappa, K. S. (2002). Growth and yield of Tomato cv. Avinash-2 in relation to inorganic fertilizers and organic manures, *South Indian Hort*, **50**(4/6):335-341.
3. Mohd, Rafi, Narwadkar, P. R, Prabhu, T. and Sajindranath, A. K. (2002). Effect of organic and inorganic fertilizers on growth and yield of tomato (*Lycopersicon esculentum* Mill.), *South Indian Hort*, **50**(4/6):522-526.
4. Naidu, A.K, Kushwah, S.S, Mehta, A.K. and Jain, P.K. (2002). Study of organic, inorganic and biofertilizers in relation to growth and yield of tomato, *JNKVV Res. J*, **35**(1/2):36-37.
5. Patil, M.B, Mohammed, R.G. and Ghadge, P.M. (2004). Effect of organic and inorganic fertilizers on growth, yield and quality of Tomato. *J. Maharashtra Agric. Univ*, **29**(2): 124-127.

6. Poul, A.S, More, S.D, Lohit, V.D. and Bodke, R.G. (2004). Effect of organic and inorganic nutrient sources on growth, yield and nutrient uptake in Tomato, *J. of Soils and Crops*, **14**(1):40-45.
7. Prativa, K.C. and Bhattarai, B.P. (2011).Effect of Integrated Nutrient Management on the growth, yield and Soil Nutrient Status in Tomato, *Nepal J. of Sci. and Tech*, **12**:23-28.
8. **RanjitChatterjee, Jana, J.C. and Paul, P.K. (2013).**Vermicompost substitution influences shelf life and fruit quality of tomato (*Lycopersiconesculentum* Mill.), *American J. of Agric. Sci. and Tech*, **1**:69-76.
9. Rodge, B.M. and Yadlod, S.S. (2009). Effect of organic and inorganic fertilizers on growth, yield and quality of Tomato(*Lycopersiconesculentum* Mill.), *The Asian J. Hort*, **4**(1):221-224.
10. Singh, B.K, Pathak, K. A, Boopathi, T. and Deka, B.C. (2010). Vermicompost and NPK fertilizer effects on morpho-physiological traits of plants, yield and quality of Tomato fruits, *Vegetable Crops Research Bulletin*, **73**:77-86.
11. **Suge, J.K, Omunyin, M. E. and Omami, E.N. (2011).**Effect of organic and inorganic sources of fertilizer on growth, yield and fruit quality of eggplant (*Solanummelongena* L.), *Archives of Applied Sci. Res*, **3**(6):470-479.

